Building a Framework for Healthy Housing

Guaranteed Performance in Affordable Housing

The SystemVision® Program in North Carolina

2008 National Healthy Homes Conference  September 15-17, 2008 in Baltimore, MD
“Affordability is a Health Issue.”

Mary Jean Brown
Sept. 15, 2008

“If it’s not energy efficient, it’s not affordable.”

Numerous energy geeks since the 70’s
Background: Goal

- Improve Energy Efficiency in every home receiving public or charitable funding at least to Energy Star level while improving home in terms of
- Health & Safety
- Durability
- Comfort
- Affordability
- Environmental Impact
The Foundation of Good Homes

SystemVision

The Building Code

- comfort
- health and safety
- environmental impact
- energy efficiency
- durability

The Building Code
The Building Code

- Defines the worst house allowable by law.

  Anonymous Architect
Background: Goal

- Institutionalize a new base platform for affordable housing that is
  - Achievable
  - Cost-effective
  - Not shooting for “greenest” or “healthiest” etc.
Background: Barriers Assessment

- What are the Barriers?
  - 1996 Ava Kuo Study
    - Institutional
    - Monetary
    - Market
    - Knowledge (or Lack Thereof)
Barriers: Institutional

- Higher cost not reflected in higher appraisal
- Limited income buyers, even if the appraisals go up
- No energy standards for new construction required by NC Housing Finance Agency [or others]
Barriers: Monetary

- No incentive for developers/builders. No evidence that resource-efficient houses sell faster or for a premium. (in 1996!)
- Some added cost
Barriers: Market

- Market demand [for resource-efficient homes] not substantial.
- Such a pent-up demand for low-cost housing that resource efficiency is irrelevant to most buyers/renters.
- If it’s not a priority for buyers, it probably won’t be a priority for builders.
- Some demand identified for lower utility costs; very little demand for other “green” features.
Barriers: Knowledge (or Lack Thereof)

- Learning curve can be steep on first project, leading to high costs & lots of time.
- Profit margins already low in affordable housing, so there is little incentive to spend more time & money on different techniques.
- Many builders take the “tried and true” approach.
This is SERIOUS stuff!

TOUCHING WIRES CAUSES
INSTANT DEATH

$200 FINE

Newcastle Tramway Authority
Overcoming the Barriers

- Extra funding from Housing Finance Agency or NC Community Development Initiative tied to
  - Mandatory Standards
  - Technical Assistance/QC Package
  - Marketing Package
Standards

1. House Air-Tightness
2. Ventilation and Moisture Management
3. Insulation and Windows
4. HVAC Sizing and Installation
5. Pressure Balancing
6. Energy Star and Appliances
7. Combustion Safety
Standards

Or, Energy Star + some basic Health & Safety
There is no subject directly connected with domestic life on which there is so large an amount of popular ignorance as ventilation.

The want of attention to ventilation arises from the fact that the poison of breathing bad air is a slow one, and though its effects are as certain as those which follow from taking doses of prussic acid, yet they are only observed remotely, and little by little. Nature does not immediately protest against slightly impure air as against want of food and water, and, therefore, we go on from day to day, suffering the accumulated evils resulting from our ignorance, and only wondering at our want of physical health and spirits.
Technical Assistance

- Plan Review
- Contractor/Subcontractor training
- On-site quality control
- Performance testing
Testing Exhaust Fan Flow
Marketing

- Training
- Certification/Guarantee
- Servicing the Guarantee
SystemVision Guaranteed Houses
Annual Production

<table>
<thead>
<tr>
<th>Year</th>
<th>Production</th>
</tr>
</thead>
<tbody>
<tr>
<td>2001</td>
<td>5</td>
</tr>
<tr>
<td>2003</td>
<td>88</td>
</tr>
<tr>
<td>2005</td>
<td>197</td>
</tr>
<tr>
<td>2007</td>
<td>385</td>
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</tbody>
</table>


From 2001 to 2007, there was a significant increase in the production of guaranteed houses, especially from 2001 to 2007.
Results to Date

- 1,730 homes certified/guaranteed
- 50 counties (out of 100)
Results to Date

74 Developers
- 37 Habitat for Humanity Affiliates
- 15 Community Dev. Corporations
- 4 Local Governments
- 3 Public Housing Authorities
- 15 Other Nonprofits
Costs Too Much?

- Average Added Cost to Do System Vision:
  - $1,500 for materials and labor for required upgrades
  - $1,050 for plan review, training, testing guarantees, admin.
- TOTAL = $2,550
Costs too much?

- Grant from NC HFA = $4,000
- Net = $1,450 for each SystemVision house!
Costs too much?

- Avg. Added Cost: $2,550
- = about $15 per month on the mortgage
- Avg. savings about $20 per month
- Even with no grant, it’s a positive cash flow for the client from day one!
**Results to Date: House Tightness**

CFM50/Sq. Ft. Envelope

- **Benchmark NC Houses:**
  - Median = .44
  - Range = .19 to 1.46

- **Program Houses:**
  - Median = .27
  - Range = .08 to .64

**Note:** 6 homes > .44; 81 homes (5%) > .35
Results to Date: Duct Tightness
Total CFM 25 / Conditioned Floor Space

- Benchmark NC Houses:
  Median = 19.5%
  Range = 4% to 79%

- Program Houses:
  Median = 3.55%
  Range = .6% to 12.7%

Note: 45 homes (3%) greater than 6% duct leakage
Results to Date: Other Factors

- **Insulation**: Benchmark = 23% under code in attics
  
  Program: 0% under code, incl. walls

- **Fresh Air Ventilation**: Benchmark = 1%
  
  Program = 100%

- **Performance Tested Spot Ventilation**: Benchmark = 0
  
  Program = 100%
Results to Date: Other Factors

- HVAC Sizing to Manual J:
  Benchmark = 12%
  Program = 100%

- Combustion Safety Tested:
  Benchmark = ?
  Program = 100%

- Pressure Balanced:
  Benchmark = ?
  Program = 100%
Results to Date: Savings

- 30% of Heating & Cooling; 15% of total
- Over $1,000,000 so far diverted from utility bills to other needs.
- Annually reducing CO$_2$ emissions by ~6 million pounds
Results to Date: Institutional

- NC Housing Finance Agency continues to affirm commitment in single-family housing
- Implemented program into single-family rehab
- Implemented program into all Supportive Housing
- Implemented ENERGY STAR into multi-family tax credit program
Barriers have changed

- Moving beyond the early adopters
- Process, process, process
- Stable funding stream
- Competent testing infrastructure
- Accessible oversight agency
- Provide proven benefits to their customers

Aubra Levine, 2007
Framing Checklist

- All penetrations with caulk.
- Windows are secure.
- Chases are secure.
- All windows are rated.
- Raised joists.
- Attic access.
- Insulation or spray.
- Backing on the joists.
- 70 CFM or greater.
- Bath exhaust.
- Accessible.

Insulation Checklist

- Items from below.
- Baffles are inserted top plate.
- No gaps, voids.
- Insulation is in.
- Kraft-faced batt.
- Insulation is in.
- Insulation is cut.
- Reliefs are cut.
- Insulation is proper after drywall.
- Caulk has been used.

Final Checklist

- Items from framing and insulation checklist are complete.
- Home has power.
- HVAC startup is complete.
- Outdoor Thermostat is installed on HVAC system (heat pumps only).
- Fresh air is filtered.
- Bath and kitchen exhaust fans are operational and vented.
- Jump-over ducts or transfer grills are installed and doors have 1/2" undercuts.
- Attic hatch is insulated and weather-stripped.
- 100% ground cover is installed over crawl space floor (crawl space only).
- Sub-floor insulation is installed to System's nine standards (crawl space only).
- R-38 attic insulation is installed.
- Two compact fluorescent lights are installed.
- Home has Energy Star labeled refrigerator.
- Home has Carbon Monoxide detector installed if applicable (see standard 7.2).
Guarantee for feedback

- Benefit to the home owner
  - A home that works
  - Support if it doesn’t
    - Financial
    - Technical
- Follow up education if needed
Key Learnings

- Discrete Package rather than “Chinese Menu” approach
- Technical Credibility
- Practical
- TA & Training
- QC
- Feedback
Key Learnings

- Change the Design Process
- Change the Marketing Process
- Change the Construction Process
High Performance Home: Mold-Safe, Moisture-Free and Energy-Efficient

Presented by Charles L. Perry, Jr.
Principal, Environmental Assurance Group
High Performance Building Innovation Center

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High Performance Home: Mold-Safe, Moisture-Free and Energy-Efficient

Questions?
High Performance Home: Mold Safe, Moisture Free and Energy Efficient

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